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Abstract

Although physical activity guidelines recommend muscle strengthening activities (MSA), public health initiatives focus predominantly on increasing aerobic activity without mentioning MSA. This study sought to identify the issues influencing pre-, peri- and post-menopausal women's intentions to perform MSA with a view to informing future interventions for these populations. Mixed methods guided by the Theory of Planned Behaviour were used to explore factors that influence women's intentions to perform MSA. In stage one, 34 women participated in either a focus group or interview. Discussions were transcribed verbatim and analysed based on menopausal status using deductive approach. In stage two, 186 women (*M* = 47 years, SD = 9) completed a questionnaire to assess participant demographics, levels of MSA, affective and instrumental attitudes, injunctive and descriptive norms, self-efficacy and perceived behavioural control. Quantitative data was analysed using descriptive statistics, bivariate correlations, regression analyses and analysis of variances. Behavioural beliefs were: improved muscular health; psychological benefits; improved body shape. Normative beliefs were: health professionals; family members; work colleagues. Control beliefs were: equipment; motivation; time constraints; knowledge; physical capability; fear of judgment. However, these beliefs were not well established. Self-efficacy was the strongest predictor of intentions ($spc^2 = 0.11$) followed by affective attitudes ($spc^2 = 0.09$) with no significant differences on TPB variables between groups. If rising rates of musculoskeletal conditions in women are to be prevented, there is an urgent need to increase women's knowledge of recommended levels of muscle strengthening with a view to promoting positive attitudes and enhancing women's sense of self-efficacy across all menopausal phases.

Keywords: Musculoskeletal diseases, ageing, prevention, muscle strengthening activities, menopausal status and Theory of Planned Behaviour

Author Contributions

Ms Julie Doherty

I declare that I contributed to the design of the study, recruitment, data collection, data analysis, wrote the paper and saw and approved the final version.

Dr Ellen, E. A. Simpson

I declare that I contributed to the design of the study, analysis of the results, write up and review of the paper and approved the final version.

Professor Melanie Giles

I declare that I participated in the design of the study, review of drafts of the manuscript and I saw and approved the final version.

Professor Alison. M. Gallagher

I declare that I participated in the design of the study, review of drafts of the manuscript and I saw and approved the final version.

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1. Introduction

1.1. Background

Rising rates of musculoskeletal conditions represents a major health burden [1], particularly for ageing women. In Europe, osteoporosis affects 22 million women aged 50+ while the prevalence of osteoarthritis [2], frailty [3] and sarcopenia rises steeply after women reach 50 years of age. The menopause contributes significantly to current trends, with research consistently showing that women are at risk of developing musculoskeletal issues due to a decline in bone mineral density [4], ovarian function and oestrogen that occurs as a result of the menopause [5]. According to previous research, muscle mass, strength and physical function can be preserved by undertaking muscle strengthening activities [6]. Consequently, activities to improve muscle strength were introduced as a core component of the physical activity guidelines (PAGs) in 2011 [7]. However, to elicit these benefits, adults are required to undertake MSA on at least two days each week with the recommendation that these activities should be undertaken in addition to aerobic physical activity.

Despite this, research to date has focused on the aerobic aspect of the PAGs with little reference to muscle strengthening; this is reflected in physical activity data. For example in the United Kingdom (UK), statistics are reported on the proportion of the population meeting recommended levels of aerobic physical activity yet rates of MSA are not. Consequently, little is known about the proportion of women undertaking MSA or the factors that influence their decision to perform this behaviour. However, evidence from the United States [8], Australia [9] and Scotland [10] suggests low adherence to this aspect of the PAGs, with older females least likely to undertake MSA. Therefore, to prevent or delay the onset of musculoskeletal conditions among women, there is a need to increase women's participation in MSA, particularly across menopausal phases (i.e. pre-, peri- and post-menopause).

Although interventions have become a popular method for promoting health behaviours including physical activity, research suggests these are more effective when derived using a theoretical framework [11]. The Theory of Planned Behaviour (TPB) [12] has been identified by National Institute of Health and Care Excellence as a framework to aid the development of complex interventions [13]. The TPB proposes that behavioural, normative and control beliefs underlie people's attitudes (i.e. "*whether the person is in favour of performing the behaviour"*), subjective norms (i.e. *"whether the person feels social pressure to perform the behaviour"*) and perceived behavioural control (i.e. "*whether the person feels in control of performing the behaviour"*). Attitudes, subjective norms and perceived behavioural control are typically viewed as composite constructs however, it is acknowledged that attitudes comprise of affective (i.e. "*feelings towards the behaviour"*) and instrumental (i.e. "*whether performing the behaviour is beneficial"*) mechanisms, subjective norm consists of injunctive (i.e. "*whether one believes it important that others want them to*

perform the behaviour") and descriptive components (i.e. "*whether one's social networks perform the behaviour"*) while perceived behavioural control includes mechanisms related to controllability (i.e. "*whether performing the behaviour is up to the individual*") and self-efficacy (i.e. "*an individual's confidence in their ability to perform the behaviour*") [14,15]. These components are believed to form intentions and in turn determine behaviour when a sufficient degree of actual control exists [16]. Therefore, as a framework for behaviour change the TPB suggests that behaviour-related information should be explored and the relative importance of the TPB components identified. Combining this information provides a more in-depth understanding of the factors that influence people's intentions to perform specific behaviours. Consequently, interventions can be directed at one or more of these determinants with the aim of promoting positive deliberation and/or behavioural strategies that aid implementation of intentions [17].

While the TPB has been used as a framework to increase our understanding of intention formations for a wide range of behaviours [18,19], including strength training [20,21] research is yet to use the TPB to understand the issues influencing women's intentions to perform MSA across menopausal phases. If rates of musculoskeletal conditions are to be minimised and the implications of the menopause on muscular health reduced, it is important that these issues are understood. From this, TPB based interventions aimed at increasing levels of MSA during key transitional phases that predispose women to these conditions can be developed, with a view to preventing or delaying the onset of these conditions. Therefore, the aim of this study was to understand the issues influencing pre-, peri- and post-menopausal women's intentions to perform recommended levels of MSA using the TPB with a view to informing future interventions for these populations.

2. Method

2.1 Study design

This study was a mixed method sequential exploratory design using the TPB as a theoretical framework. Qualitative methodology was employed in stage one to understand the cognitive processes that underlies pre-, peri- and post-menopausal women's decision to performing MSA. While quantitative methodology was used to determine the TPB components that predict intentions and the relative importance of those predictors. These methods were combined to provide an in-depth understanding of the factors that influence women's intentions to perform MSA.

2.2 Stage one: qualitative study

2.2.1 Participants

Women were recruited through community groups and organisations in Northern Ireland (NI) that were known to the researcher. Characteristics of menses and age were used to select participants based on menopausal status. Women <48 years of age reporting regular menses were defined as pre-

menopausal; women >40 years of age but less than 55 years of age reporting irregular menses were defined as peri-menopausal; and post-menopausal was defined as cessation of menses for >12 months due to the menopause. Menopausal status for those reporting a hysterectomy or use of contraception was determined based on the following criteria: pre-menopausal, <48 years of age; peri-menopausal >48 years but <55 years of age; and post-menopausal >55 years of age. Participants were excluded based on the following criteria: early menopause defined as cessation of menses < 40 years of age; self-reported bilateral salpingo-oophorectomy.

2.2.2 Measures and procedures

Potential participants were provided with an information sheet, consent form and a short questionnaire including sociodemographic items (i.e. age, level of education, marital status) and characteristics of menses (i.e. regularity of menses, time since previous menses and reasons for cessation). Once consent was obtained, participant's responses were reviewed to determine eligibility and menopausal status. Those meeting the inclusion criteria were invited to attend an interview or focus group depending on availability. During each discussion participants were provided with information on the recommended levels of MSA in line with the PAGs [7] and asked to share their views on undertaking weekly recommended levels of MSA using elicitation questions based on guidance provided by [16] or conducting exploratory TPB research. In total, nine interviews and six group discussions comprising two to eight participants were conducted by the researcher (JD). Length of discussions varied from 30 minutes to 1 hour 10 minutes, were audio taped and transcribed verbatim.

2.2.3 Data analysis

Transcripts were subjected to thematic analysis, a method used within qualitative research to identify, analyse and report themes within data. In line with the procedures for thematic analysis, the transcripts were read several times (JD), to ensure familiarity and initial observations noted. Patterns in the data were identified and codes established and then refined [22]. The themes were named and assigned to their corresponding TPB constructs. A selection of transcripts were analysed by a second reviewer (EEAS) and an inter-observer agreement calculated by dividing the number of observed agreements by the number of judgements.

2.3 Stage two: quantitative study

2.3.1 Participants

Women were also recruited to this stage of the study through community groups and organisations in NI that were known to the researcher. Participants were selected based on menopausal status which was determined based on the characteristics described previously. The number of participants required was estimated using the following formulation N = 50+ 8m (m is the

number of Independent variables) [23]. Therefore, a minimum sample of ≥ 112 participants was considered acceptable.

2.3.2 Measures and procedures

A questionnaire was used to assess a two component model of the TPB. Three items per component were included and a seven point Likert scales used as a response format (Table 1). The questionnaire also included (1) demographic items: age; marital status; level of education; height and weight (2) characteristics of menses: regularity of menses; time since previous menses; and reasons for cessation; and (3) a further three items to assess MSA (i.e. 'during the last seven days on how many days did you do strengthen activities'; 'how much time did you spend doing strengthening activities on one of those days'? and 'what areas of the body did you work'. Participants received an information sheet and provided signed consent before completing the questionnaire. The data was collated and mean scores computed for each construct with higher scores indicting higher levels on each of the TPB components.

2.3.3 Data analysis

Data was analysed using SPSS v22. Checks for missing data, normal distribution, outliers, multicollinearity and homogeneity of variance were conducted. A skewness range of +2 to -2, a variance inflation factor (VIF) statistic of less than 10, kurtosis scores below 10 and a homogeneity score below 0.05 was deemed acceptable. Descriptive statistics, Pearson's bivariate correlational analysis, hierarchical regression analyses and analysis of variance (ANOVA) were computed in order to explore the data.

2.4 Results

2.4.1 Stage one: qualitative study

Stage one included 35 women, 16 pre- (M_{age} = 32 yr, SD=8.04), 8 peri- (M_{age}= 49 yr, SD=2.25) and 11 post-menopausal (M_{age}=59 yrs, SD=3.33). Of those who participated, post-menopausal women were least likely to be university educated while peri-menopausal participants were most likely to have a university level qualification. In relation to marital status, 50% of pre-menopausal women reported being in a relationship. This is in contrast to majority of peri- and post-menopausal women who were married (75% and 66% respectively). In order to understand the issues that underlie pre-, peri- and post-menopausal women's decision to undertake MSA the findings are discussed below in the context of the TPB. The results are evidenced by exemplar quotes provided in Tables 2, 3 & 4 for behavioural, normative and control beliefs respectively. There was an inter observer agreement of 96%.

2.4.1.1 Behavioural beliefs

Outcomes for behavioural beliefs are presented in Table 2. Overall, women held negative attitudes towards undertaking MSA. However, it was apparent that women were unfamiliar with the recommended levels of MSA and as a result unsure of the types of activities that constitutes muscle strengthening and in some instances the outcomes associated with this behaviour. Despite this, improved muscular health and psychological benefits were mentioned as advantages of undertaking this behaviour. In addition, some pre- and post-menopausal women reported that MSA would improve their body shape while others believed that this would have adverse effects on body shape for example, larger muscles. However in general, MSA were associated with an increased risk of pain/injury and perceived as being too hard, boring and unnecessary.

2.4.1.2 Normative beliefs

Outcomes for normative beliefs are presented in Table 3. Pre- and peri-menopausal women mentioned that health professionals would advocate undertaking MSA but this was unlikely to influence participation in MSA. Other people's PA behaviour, specifically work colleagues and immediate family members was more likely to influence intentions to perform MSA. Interestingly, post-menopausal women did not report any normative beliefs.

2.4.1.3 Control beliefs

Outcomes for control beliefs are presented in Table 5. Pre- menopausal women reported 'equipment' as an enabling factor. Knowledge, time constraints, motivation, a fear of being judged and current capability levels emerged as factors that prevent women from undertaking MSA, although these views varied across the study groups. In general, women found it difficult to identify enabling factors, expressing concerns about how to undertake MSA and how this would fit into their current routines.

2.4.2 Stage two: quantitative study

Stage two included 186 women (M_{age} = 47 yrs, SD = 9) of which 76 were pre-menopausal (M_{age} = 38 yrs, SD = 5.3), 45 were peri-menopausal (M_{age} = 51, SD = 2.5) and 65 post-menopausal (M_{age} = 55, SD = 4.8). Educational attainment across groups did not differ with the majority of participants reporting a university level education (78%, 78% & 74% for pre-, peri- and post-menopausal participants respectively). Post-menopausal women were more likely to be married (77%). The majority of participants (70%) did not undertake any MSA, 20% were undertaking some MSA but were not achieving recommended levels and 10% were currently undertaking recommended levels of MSA. Post-menopausal women (15.3%) were more likely to undertake the weekly recommended levels of MSA compared to their pre- and peri-menopausal counterparts (7.9% & 4.3% respectively).

2.4.2.2 Correlational analyses between study variables and intention

A Pearson's Bivariate correlational analysis was computed to explore the relationships between study variables and intention to perform weekly recommended levels of MSA. The findings from this analysis are presented in Table 5 and show that menopausal status, BMI and age did not correlate with intention to perform MSA, whereas all TPB variables correlated significantly with intention. Self-efficacy emerged as having the strongest relationship with intention followed by affective attitude, instrumental attitude, subjective norm, perceived behavioural control and descriptive norm, respectively.

2.4.2.3 Predictors of intention to perform strengthening activities

A hierarchical multiple regression analysis was computed to identify the factors predicting women's intention to perform weekly recommended levels of MSA. Outcomes are presented in Table 6 and show that sociodemographic, menopausal status, BMI and age did not significantly predict intentions in step one of the analysis. However, there was a significant change in R^2 in step two with the TPB variables accounting for 58% of the variance in intentions to perform MSA. The final model explained 60% of the variance with self-efficacy ($spc^2 = 0.11$) and affective attitudes ($spc^2 = 0.09$) making unique contributions to the prediction of intention to perform MSA. Thus indicating that intention to perform MSA increases among women with more favourable affective attitudes towards undertaking the behaviour ($\beta = .279$, $p<.001$) and higher levels of perceived capability ($\beta = .382$, $p<.001$). Instrumental attitudes, descriptive and injunctive norms and perceived behavioural control did not significantly predict intentions.

2.4.2.4 Group differences in TPB predictor variables

A series of ANOVA were computed in order to explore differences between groups on intention and significant predictors of intention (i.e. self-efficacy and affective attitudes). Outcomes of these analyses are presented in Table 7 and indicate no significant differences in mean self-efficacy, affective attitude and intentions score based on menopausal status.

2.5 Discussion

2.5.1 Key findings

To our knowledge this is the first study to explore and identify the issues that influence pre-, peri- and post-menopausal women's intentions to perform weekly recommended levels of MSA using the TPB. The present study found that these women were unfamiliar with recommended levels of MSA and held negative attitudes towards performing this behaviour. Quantitative data provided additional support for these findings with affective attitudes (i.e. participants feelings towards

undertaking MSA) and self-efficacy (i.e. participants confidence in their ability to perform MSA) emerging as significant predictors of intention to perform MSA independent of menopausal status.

In line with the aims of this study, participants behavioural, normative and control beliefs were explored in order to understand the cognitive processes that underlie women's decision to perform MSA. While views and opinions were reported, these were inconsistent and influenced by limited knowledge on this topic. Given that knowledge is consistently reported as a key determinant of intentions [18,19], the present study highlights the need to increase women's knowledge of MSA, the associated benefits and how to complete them in addition to aerobic physical activities. Increasing women's knowledge of MSA will help establish clear views and opinions towards undertaking MSA among women at key transitional phases. While increasing knowledge of home-based activities could minimise control factors such as concerns relating to physical capability, fear of being judge and time constraints. However, previous research suggests that this approach may have limited impact if environmental factors are not promoted at the same time [24]. This can be addressed by informing women of opportunities to undertake MSA within their local environments in addition to home-based MSA.

The findings showed that participation in MSA is associated with women's attitudes towards this behaviour. However, it emerged that women's intentions were influenced by the affective component of attitudes (i.e. their feelings towards the behaviour) rather than instrumental component (i.e. the extent to which performing a behaviour would be advantageous). This finding is common within physical activity research [25] therefore to meet the needs of distinct populations more studies need to explore the components of attitude separately. Given that in the present study, women were found to have negative attitudes towards undertaking MSA, there is a need to promote positive attitudes across menopausal phases by changing how these women feel about performing MSA. This may be achieved indirectly by increasing their knowledge of MSA and the associated benefits. However, providing women with facilitated experiences of MSA that allows them to model these behaviours could address this issue. The findings suggest that pre-, peri- and post-menopausal women's affective attitudes could be increased by promoting the psychological benefits of undertaking MSA. Given that improved body shape was also mentioned as an advantage of undertaking MSA among pre- and post-menopausal women, it is possible that these women though about undertaking MSA to better their appearance and perceptions of their ageing appearance. Therefore, pre- and post-menopausal women's decision to perform MSA may be influenced by feelings associated with improved body image.

Consistent with previous physical activity research, health professionals such as doctors, were viewed as individuals who would advocate participating in this behaviour [26]. However, participants

suggested this belief was not a sufficient motivator to perform MSA unless undertaking MSA was necessary to improve a personal health problem. It emerged that the behaviour of relevant others such as immediate family members and work colleagues was more likely to have a direct impact on their participation in MSA. Thus, suggesting that others behaviour, referred to as descriptive norms within the TPB, may influence levels of MSA among women. Despite this, when the quantitative data was analysed, whether these women believed that others wanted them to undertake MSA (i.e. injunctive norm) or that others were participating in MSA (i.e. descriptive norm) did not predict intention. Therefore, after combining the results from both stages, the findings suggested that social pressure is unlikely to influence intentions to perform MSA. However, the life course approach adopted in the present study may have influenced this finding as this is in contrast to previous research using the TPB to explain strengthening training in older adults [20].

Evidently, if participation in MSA is to increase in women, it is essential that their sense of self-efficacy is improved. This finding is consistent with previous research [27] and suggests that there is a need to increase pre-, peri- and post-menopausal women's confidence in their ability to perform MSA. Increasing awareness of MSA may impact women's confidence in their ability to perform MSA however, the results indicate that barriers such as time constraints, motivation, fear of being judged and physical capabilities need to be addressed in addition to increasing knowledge. The control factors reported in this study provide additional support for previous research that identified factors that influence MSA in women [28]. However, the present study identified more barriers than enabling factors across all menopausal groups. This finding may (at least in part) be explained by the fact the majority of participants were not meeting recommended levels of MSA [29].

2.5.2 Limitations and future research

As with all studies, there are a number of limitations that should be acknowledged. Firstly, the approach adopted to determine menopausal status, self-reported menopausal status is not always accurate although characteristics of menses and age are commonly used in previous research to determine menopausal status [30]. Secondly, the results are representative of a subsample of women in NI and therefore may not be generalizable however suggests that further research in this area is needed. Finally, participants perspectives on MSA were not well established which may have resulted in respondents providing responses viewed as socially acceptable and not indicative of the issues underlying their decision to participate in MSA. Future research needs to explore the proportion of pre-, peri- and post-menopausal women meeting recommended levels of MSA on a larger scale. Also, in addition to identifying the prevalence of MSA in line with recommended levels, it would be interesting to look at the intensity of these activities. Given that the post-menopausal group in the present study were in the early stages of post-menopause, future studies should include an older cohort of post-menopausal women, in turn, women's intention to undertake MSA could be

compared between the early and late stages of post-menopause. Finally, it would be beneficial for research to further explore how the barriers presented in this research influence pre-, peri- and post-menopausal women's intentions to perform MSA.

2.5.3 Conclusions

These results suggest that women's intentions to perform MSA are low across the life course with intentions primarily influenced by a lack of knowledge, perceptions of self-efficacy and negative attitudes towards undertaking MSA. If rising rates of musculoskeletal conditions are to be prevented, women need to be made aware of the recommended levels of MSA and how to perform these in addition to aerobic physical activities. In addition, there is a particular need to increase women's confidence in their ability and feelings towards performing MSA. The findings presented in the current study can be used to develop a TPB-based intervention to promote pre-, peri and post-menopausal women's participation in the recommended level of MSA. As the findings were independent of menopausal status, interventions (and intervention components) seeking to increase MSA could do so across menopausal phases. The findings presented in this paper could also be used by practitioners working with pre-, peri- and post-menopausal women to increase participation in MSA during these key transitional phases.

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Table 1

Questionnaire items and Cronbach's α reliabilities for each TPB assessment measure

TPB construct	n	Questionnaire items	**α**
Intention	3	I intend/will try/have decided to do activities to improve muscle strength on at least two days each week: disagree/agree	.959
Instrumental attitude	3	I think that doing activities to improve muscle strength on at least two days each week would be: bad/good, harmful/beneficial, useless/useful	.883
Affective attitude	3	I think that doing activities to improve muscle strength on at least two days each week would be: pleasant/unpleasant, boring/not at all boring, enjoyable/unenjoyable	.917
Injunctive norm	3	I think that most people who are important to me would support/encourage/approve of me to do activities to improve muscle strength on at least two days each week: disagree/agree	.867
Descriptive norm	3	Most of my friends/work colleagues/family will do activities to improve muscle strength on at least two days each week: disagree/agree	.855
Controllability	3	The decision to do activities to improve muscle strength on at least two days each week is beyond my control, I have control over whether or not I to do activities to improve muscle strength on at least two days each week, whether or not I do activities to improve muscle strength on at least two days each week is up to me: disagree/agree	.756
Self-efficacy	3	I am confident that I could do/I am capable of doing activities to improve muscle strength on at least two days each week. I believe I could do activities to improve muscle strength on at least two days each week: disagree/agree	.929

Note. Abbreviations: PBC = perceived behavioural control. Items were developed to include target, action and time elements. In line with the TPB, the action element was enhanced as a context for performing strengthening activities was not included within the operational definition of the behaviour.

Table 2: *Behavioural beliefs and exemplar quotes from pre-, peri- and post-menopausal participants*

Model construct	Beliefs	Exemplar quotes		
		Pre	Peri	Post
Behavioural beliefs	**Perceived advantages** Improves muscular health (pre, peri & post) Improves body shape (pre & post) Psychological benefits (pre, peri & post)	• *"I think for general health, for general physical ability"* • *"You would feel a bit stronger maybe"* • *"It's definitely better I think for your shape"* • *"things like the swimming and yoga that's actually quite relaxing*" • "*You would probably feel better in yourself*"	• "*Well it is going to be better to feel stronger*" • "*Like muscle strength and things like that as regards to like arthritis and all those conditions that sometimes occur later in life. It could possibly reduce the risk of that or even if it was there it could make it less…it wouldn't be as severe*" • "*I suppose em mental health and everything improves as well"*	• "*It's good to ward off or to help if you've got osteoporosis*" • " *It keeps your bones healthy*" • "*A better looking body, or is that too late*?" • "*I suppose it tones you up more doesn't it? We could be doing without these batwings…."* • "*It makes you look better, feel better*" • " *You feel more, you feel, I think you definitely feel a bit more confident*"
	Perceived disadvantages Risk of injury/pain (pre, peri & post) Boring/unpleasant (pre, peri & post)	• "*You could pull a muscle*" • "*The pain. It would be the pain that would put me off the most*" • "*The boredom*" • "*It bores the life out of me the same with Pilates or yoga or any of them it just bores the complete life out of me*"	• "*Well muscle strengthening exercises you know there is the pain thing involved in that*" • "*if you're doing them you can, you can probably injure yourself unless you know what you're doing*" • "*I done kettle bells I signed up for a 5 week course and done one night and never went back again because I could not walk up and down the stairs for at least 3 days after it*" • "*I'm very lazy like that because I don't enjoy it"* • *"Well it is very boring, would be the top one for me"*	• "*The pain again would be you know, the pain afterwards*" • " *Well aye, it strengthens your legs it does but sometimes you get pains as well*" • "*The only problem with the muscle strengthening exercise I find is that they tend to be more repetitive and boring than aerobic exercises. You don't get the same variety of activity you know, its just doing it and doing it doing it*"

Note. Abbreviations are as follows: pre = pre-menopausal; peri = peri-menopausal and; post = post-menopausal. In order to explore behavioural beliefs participants were asked if there were any advantages or disadvantages of undertaking MSA. Participant's responses were coded based on menopausal status and the advantages or disadvantages considered as behavioural beliefs. In total, six focus groups (pre, n=2; peri, n=2 and post n=2) and nine interviews (pre, n=3, peri, n=4, post, n=2) were conducted with pre- (n=16); peri- (n=8) and; post-menopausal (n=11) participants.

Table 3: *Normative beliefs and exemplar quotes for pre-, peri- and post-menopausal participants*

Model construct	Beliefs	Example quotes		
		Pre	Peri	Post
Normative beliefs	**People who approve** Health professionals (pre & peri) Work colleagues (pre) Immediate family members (pre & peri)	• "*Doctors*" • "Just various health professionals" • "*I would say work colleagues. Sometimes you would follow the trend*" • *"Well my dad and my boss both would"* • "*Your partner*" • "*Well yeah my husband would be happy if I was doing it but I don't think his approval makes a lot of difference*"	• "*So I suppose maybe health professionals or allied health professionals would encourage certain things as well*" • "*my sister probably*" • "*It's interesting because my new husband does a lot of exercises for his back because he's had back injuries and he is, uh he's actually been advising me and saying, you should do this and showing me things to do on the floor and stuff*"	

Note. Abbreviations are as follows: pre = pre-menopausal; peri = peri-menopausal and; post = post-menopausal. In order to explore normative beliefs participants were asked if there were any individuals or groups who would approve or disapprove of them undertaking MSA. Participant's responses were coded based on menopausal status; individuals and groups identified as approving or disapproving were considered as normative beliefs. In total, six focus groups (pre, n=2; peri, n=2 and post n=2) and nine interviews (pre, n=3, peri, n=4, post, n=2) were conducted with pre- (n=16); peri- (n=8) and; post-menopausal (n=11) participants.

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Table 4: *Control beliefs and example quotes for pre-, peri- and post-menopausal participants*

Model constructs	Beliefs	Example quotes		
		Pre	Peri	Post
Control beliefs	**Facilitating factors** Equipment (pre)	• "*Equipment, if you had the equipment to do it with at home rather than travelling to the likes of a gym or something*"		
	Perceived barriers Time constraints (pre, peri & post) Knowledge (pre, peri & post)	• "*I find time. It's trying to fit it in*" • "having time" • "The knowledge and understanding of not having somebody that needs to teach you or lead you that you can do it on your own"	• "*it's just family constraints at the moment is really the only thing that would be hindering me and hopefully those in the next year or two will lighten and we'll get back to it*" • "*I try them at home too but un it's finding the time*" • "*I mean I 'm still not 100% sure if I know exactly what is meant by muscle strengthening exercises*" • "*Well I don't have a huge amount of knowledge about strengthening exercises I have to say*"	• "*It's time*" • "*You don't necessarily know which ones to do*" • "*A wee bit more instruction maybe would be good*"

Table 4: *cont.…. Control beliefs and example quotes for pre-, peri- and post-menopausal participants*

Model constructs	Beliefs	Example quotes		
		Pre	Peri	Post
Control beliefs	Motivation (pre , peri & post) Current capabilities (pre & peri) Fear of judgement (pre & peri)	• "*you feel like you don't need that at the minute in time depending on your age"* • *If I had the motivation to do any of it, I would do it"* • "*If I was fitter it might not hurt as much*" "*Being fit enough to do it*" • *"I You know if you go to a hall or something and theres people you don't really like you maybe would be inclined not to go back then because you wouldn't want to be exercising in front of them*"	• "*I find people who do gym and weights and all once they stop doing that everything just turns to flab and fat so that gives me no motivation to do anything like that*" • "*Well I'm just saying personally I, I wouldn't do it*" • *"Sometimes injury prevents you from doing that*" • "*I would have weakness in my hands now that I wouldn't of have 5 years ago you know and varies different wee aches and pains and muscly things but you know nothing serious but I would imagine I would get back problems as well if I was doing anything very strenuous* " • "*I suppose maybe people trying to eh undermine you or humiliate*" • "*Well probably nobody is taking the blind bit of notice of you but I just feel really self-conscious*"	• "*Just getting motivated*" • "*I think you have to be in the right frame of mind to do it as well*"

Note. Abbreviations are as follows: pre = pre-menopausal; peri = peri-menopausal and; post = post-menopausal. In order to explore control beliefs participants were asked if there were any factors or circumstances that would prevent or enable them to undertake MSA. Participant's responses were coded based on menopausal status and the factors that prevent or enable participation in MSA considered as control beliefs. In total, six focus groups (pre, n=2; peri, n=2 and post n=2) and nine interviews (pre, n=3, peri, n=4, post, n=2) were conducted with pre- (n=16); peri- (n=8) and; post-menopausal (n=11) participants.

Table 5

Study variables	1	2	3	4	5	6	7	8	9	10
1. Menopausal status	-	**.837****	-.014	.074	.055	.097	.132	.009	.070	.096
2. Age	-	-	-.017	.037	.084	**.147***	.114	.046	**.158***	.090
3. BMI	-	-	-	-.024	-.096	.093	.114	-.084	-.101	-.050
4. Affective attitude	-	-	-	-	**.583****	**.476****	**.337****	**.484****	.033	**.593****
5. Instrumental attitude	-	-	-	-	**-**	**.606****	**.202****	**.606****	**.190***	**.586****
6. Injunctive norm	-	-	-	-	-	-	**.363****	**.522****	**.327****	**.553****
7. Descriptive norm	-	-	-	-	-	-	-	**.163***	.014	**.285****
8. Self-Efficacy	-	-	-	-	-	-	-	-	**.571****	**.683****
9. PBC	-	-	-	-	-	-	-	-	-	**.360****
10. Intention	-	-	-	-	-	-	-	-	-	-

Pearson's bivariate correlations of study variables

Note. Abbreviations are as follows: BMI = Body Mass Index; age = age in years; PBC = Perceived Behavioural Control Pearson's Bivariate Correlation analysis for all participants (pre- n=76; peri-, n=45; post-menopausal n=65). Significant correlations are identified in bold *P<0.05; **P<0.01.

Table 6

Summary of hierarchical regression analyses with intention to perform strengthening activities as the dependent variables, and socio-demographics, menopausal status, BMI and TPB variables as predictor variables

Step	Predictor variables	R^2	ΔR^2	F	P
1	Socio-demographics, menopausal status and BMI	.018	-.041	F(10, 165) = .304	.979
2	TPB variables	**.602**	**.562**	**F(16, 159) = 15.02**	**<.001**

Note. The first step in the regression analysis involved entering socio-demographic information of age, educational level, marital status, menopausal status and BMI. In step two the TPB variables affective and instrumental attitude, injunctive and descriptive norm, perceived behavioural control and self-efficacy were entered. It should be noted that step two includes the variables from step one. Significant increases in R^2 indicated in bold.

Table 7

Means weights for intention and predictor variables by menopausal status

Variable	Pre	Peri	Post	F	P
Self-efficacy	5.37 (SD,1.51)	5.70 (SD, 1.60)	5.39 (SD, 1.62)	F(2, 180) = .675	.510
Affective attitudes	4.72 (SD, 1.65)	4.98 (SD, 1.55)	4.98 (SD,1.65)	F(2, 180) = .577	.562
Intention	4.26 (SD, 1.95)	4.55 (SD, 1.92)	4.68 (SD, 1.88)	F(2, 179) = .865	.423

Note. Three distinct analysis of variance analysis were computed to explore difference between groups on intention and significant predictors of intention (i.e. self-efficacy and affective attitude).